The Top 10 Energy Wasters in K–12 Facilities (and What to Do about Them)

By Dave Leathers

Every year, K–12 facilities waste millions of dollars in excess energy consumption. Those dollars may take the form of lost heat through walls, windows, doors, and roofs. Or the villain may be poorly conceived or mismanaged control systems. Those excess funds that districts are sending to the local utility companies could be invested "at home" to improve the facility and work toward a zero net-energy environment.

Start with the following list of top energy wasters and strategies to mitigate them.

1. Inefficient Energy Management System

A poorly configured energy management system can waste 20%–25% of your gas and electricity dollars. Align yourself with a control professional who not only understands how to "write code" but also

- Integrates the functions of your mechanical systems, using concepts of time-of-day scheduling, ventilation control consistent with space use, optimized start-stop, free cooling, and heat recovery;
- Demonstrates a working knowledge of the rate structures offered by your utility company and ways to manage your mechanical systems to function within the restrictions of those structures; and
- Develops graphic interfaces that a novice user can understand and navigate.

Although often cursed, an energy management system can be one of your greatest assets.

2. Lack of Central Plant Optimization

The typical workhorse components of your heating, ventilating, and air-conditioning system are boilers, chillers, pumps, and cooling towers. They can look intimidating and if not properly optimized can be very costly to operate. For example, if the burner on a boiler is improperly calibrated, it can cause a boiler designed to operate at 80% efficiency to run at 60%.

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Develop a relationship with a mechanical systems service organization that has a verifiable positive record in providing preventive maintenance on central plant components. Again, as with the controls, the service organization must be able to articulate a working knowledge of utility rates so as to help "right size" equipment or offer higher-efficiency alternatives to your current equipment.

In addition, your energy management professional must be able not only to program your central plant to

function in harmony with your K–12 building operation but also to exploit opportunities in the utility rate structures.

3. Postponed Routine Preventive Maintenance

Even the most routine maintenance, like changing filters, can greatly enhance the energy efficiency of a building system. The facilities management staff should review the operations and maintenance manuals for each piece of equipment and use that information to develop a list of maintenance tasks, such as boiler cleaning, belt tensioning, lubrication, and chemical treatment. From there, they must integrate the task list into a calendar. Contract with a preventive maintenance firm or purchase a computer software program to track tasks and generate reminders.

4. Domestic Hot Water Systems

Domestic hot water systems are also prime candidates for promoting energy conservation. Centrally located domestic water heaters with large storage capacities are often designed for the anticipated demand of locker room shower use occurring simultaneously with dishwashing and general restroom hand washing.

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A strong energy partner can evaluate the domestic water system as it relates to actual use. It may be advantageous to distribute small point-of-use water heaters for hand washing in restrooms, to develop a dedicated system for the kitchen, and to install time-of-day controls. Consider demand-based water heating at shower locations. This approach can eliminate long runs of domestic hot water distribution piping with the associated energy losses and can eliminate the losses associated with large storage tanks.

5. Inefficient Lighting Systems

Are the gym lights left on all day because they take so long to "warm up"? Maybe the daylight in the lobby or cafeteria would be more than enough on a sunny day, but the "keyed light switch" makes it inconvenient to turn off the lights.

Lighting systems are making tremendous advances in technology and efficiency; in fact, simple lighting controls along with florescent and LED technologies are making two-year-old lighting systems obsolete.

Consider systems like occupancy control, daylight harvesting, and automatic dimming as cost-effective ways to reduce your electricity consumption and energy demand profiles.

6. Traditional Pumping Systems

Many K–12 facilities use pumps to allocate hot water and chilled water from the central plant to the distributed heating and cooling systems. By design, these pumping systems can meet the greatest demand for heating and cooling imposed by occupancy and weather conditions. In fact, in designing the pumping systems, the systems engineer likely assumed that all areas of the building peaked simultaneously.

Yet we know the students are in the cafeteria at lunchtime and not in the classrooms, and the gym rarely sees full occupancy on the hottest, sunniest days of the year. As a result, there is ample opportunity for the pumping systems to circulate "less-than-design" flows as much as 98% of the year. Consider variable frequency drives, reduced pumping capacity, parallel pumping, primary and secondary pumping, or other technologies to immediately lower your electric bills.

7. Wasteful Boiler Systems

As systems age, they tend to become less efficient. Hot water boilers are no exception. The burner components wear and become "sloppy"; the heat transfer surfaces get dirty both inside and out; and controls need recalibration. Preventive maintenance can keep a boiler at its best for many years; yet there is more to consider.

Don't just assume that because your facility is new, the boiler plant is capable of delivering efficiently generated heat throughout all ranges of use.

Much like pumping systems, boilers are selected to meet the greatest potential demand, so for 90% of the year they are oversized. An energy professional should be able to review your gas consumption history and evaluate the potential advantages of a high-efficiency "light-load" boiler.

8. Outdated Steam Systems

Many older K–12 facilities use steam boilers and steam distribution systems as a building's heating source. By their very nature, steam systems are less efficient than hot water heating systems. They operate at higher temperatures, thereby losing more "up the flue." Consequently, they have a constant demand for makeup water and chemical treatment and the need to heat cold "makeup water" to steam temperatures. They are also much more difficult to control. Because steam systems operate at higher temperatures, the piping systems have greater losses. And when you consider steam traps and condensate pumps, they are more costly to maintain.

The best approach is to replace the steam plant and distribution system with an alternative; however, the cost for this work may be more than the utility savings can justify. In those cases, have your energy partner evaluate technologies like periodic trap inspections, flue gas heat recovery, enhanced piping insulation, and heat recovery

at locations where condensate is vented to the atmosphere.

9. Outdated Plumbing Fixtures

K–12 facilities are huge consumers of water. Much like lighting, improvements in plumbing fixtures have been swift in the past three to five years. Many fixtures that formerly consumed 2.5 or 1.6 gallons per flush can now be replaced with fixtures that use 1.1 or 0.8 gallons. Furthermore, you can decrease your water cost with low-flow faucets and showerheads and the application of sensor-based technology.

10. Retro-Commissioning

School districts have used commissioning for years. By definition, commissioning is the methodical evaluation of systems and controls to ensure that their performance is consistent with the design intent of the original architect and engineer.

Retro-commissioning is also a methodical evaluation of your building systems; however, the focus is shifted to make the building function efficiently as it is currently used. Often, buildings are remodeled or the function of rooms has changed; yet little consideration is given to the effect of energy use as a result of such changes.

Additionally, schools may design a building with the anticipation of particular enrollment figures that have changed or have not yet been met. These, and similar issues, justify the investment in retro-commissioning. If for no other reason, it can enhance comfort and therefore the learning environment.

Start Now

This list of tips, steeped in engineering and technical details, may seem overwhelming. So where to do you start?

1. Remember, the money is in your budget to make the appropriate modifications. It is currently being spent as excess energy consumption. Reinvest those dollars in the form of payments to retire an investment in energy security.
2. Be sure to benchmark your utility consumption against other K–12 facilities in your geographic area. The U.S. Department of Energy, Energy Star, utility companies, and others all have benchmarking information. In addition, firms that specialize in energy work can evaluate your buildings. And don't be surprised to learn that your new, supposedly efficient, five-year-old building is an energy hog!
3. Find a professional energy services firm that can help you integrate the process. Some firms specialize in energy analysis and retrofits, but invest some effort in checking their references. Talk to your peers and find out who they have used and whether they had a good experience that resulted in real savings.
4. Don't become enamored by all the "renewable technologies" currently being promoted. Yes, they are great technologies and will ultimately allow the United States to become more energy independent. But you should first focus on what you can do to make your facility efficient. For example, why invest in a 200-kilowatt solar panel system to generate power you would have otherwise not used?

Remember, you can't tell who won the game without a scorecard. Don't just pay the utility bills—track them. Ensure that you have developed an energy baseline before you start your energy projects and then, on a monthly basis, compare your current consumption to the baseline.

Make sure you are winning the energy savings game!

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